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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/060,842

01/29/2002

Kanwal K. Raina

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06/29/2004

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EXAMINER

GUHARAY, KARABI

ART UNIT

PAPER NUMBER

2879

DATE MAILED: 06/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Applicati n No.

10/060,842

Applicant(s)

RAINA, KANWAL K.

Examiner

Karabi Guharay

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on Amendment, filed on 12 April 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19 and 31-36 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 31-36 is/are allowed.
- 6) ☒ Claim(s) 1--3, 6, 8-14, 19 is/are rejected.
- 7) ☒ Claim(s) 4,5,7,15,16 and 18 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

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Amendment, filed on 12 April 2004 has been considered and entered.

Amendment of specification and Amendments of claims 1 & 9, overcome the objection to claims 1-8 & 9-19.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-2, 6, 8-12, 17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (US 6137212), in view of Hong (US 5969386).

Regarding claim 1, Liu et al. disclose a field emission display device (Fig 8 and Fig 9) comprising a faceplate 50, and a base plate 20, a luminescent phosphor coating 58, applied to a lower surface of the faceplate 50 to form pixel sites (lines 51-56 of column 4), and a cathode member 40, formed on the base plate 20 to form individual electron emission sites which emit electrons to activate the phosphor (lines 14-15 of column 2), comprising a semiconductor layer 26 (see Fig 6, lines 66-67 of column 3 & lines 3-4 of column 4) overlying a substrate 20 (base plate), the semiconductor layer 26 including a tip 30 (Fig 6), an aluminum layer 22 surrounding the tip 30 (lines 60-65 of column 3), an insulating layer 32a surrounding the emitter tip 30 and overlying the aluminum layer 22 (lines 10-12 of column 4), a conductive layer 34a surrounding the tip 30 and overlying the insulating layer 32a (lines 20-22 of column 4).

But Liu et al. fail to exemplify that the aluminum layer (22) incorporate nitrogen.

However, Hong discloses an aluminum layer (23a of Fig. 3), used for gate line or contact pattern in a display device (Fig. 4a, Fig. 4b) incorporating nitrogen throughout the aluminum layer (lines 45-51 of column 5), in order to reduce formation of hillocks in the aluminum layer (see abstract and lines 24-45 of column 5).

Thus it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate nitrogen into the aluminum layer of Liu et al., as taught by Hong, since this will suppress hillock formation in the aluminum layer.

Regarding claim 2, Liu et al. teach a conductive layer (gate layer 34a) comprises a second aluminum layer (lines 20-22 of column 4), however, fail to teach that the conductive layer (gate layer 34a) incorporates nitrogen.

However, Hong teaches gate layer (23a) comprising aluminum incorporating nitrogen. Same reason for combining art as in claim 1 applies (see rejection of claim 1).

Regarding claim 6, Liu in view of Hong teach all the limitations of claim 6 except for explicit teaching of aluminum layer having resistivity of less than  $10 \mu\Omega$  cm.

Hong teaches that the introduction of nitrogen ion in the aluminum layer results low resistance of aluminum layer (lines 46-50 of column 6), and further

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teaches that resistivity of the aluminum layer can be controlled by the dose of nitrogen ion implantation (lines 53-55 of column 5).

It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *MPEP 2144.05 II A*.

Thus it would have been obvious to one having ordinary skill in the art at the time the invention was made to have resistivity of aluminum layer less than  $10\ \mu\Omega\ \text{cm}$ , since optimization of prior art is within the skill of the art.

Regarding claim 8, Hong discloses that the aluminum layer is substantially hillock-free (lines 65-67 of column 5). The same reason for combining art as in claim 1 applies.

Regarding claim 9, Liu et al. disclose a field emission cathode 40 (Fig. 7) comprising a substrate (20), an emitter tip (30) formed on the substrate, an aluminum film 22 overlying the substrate (lines 60-65 of column 3) and surrounding the emitter tip, a gate layer (34a) formed above the aluminum film and surrounding the emitter tip (see Fig 7 and Fig 8, lines 20-22 of column 4).

But Liu et al. fail to exemplify that the aluminum film (22) includes nitrogen.

However, Hong discloses an aluminum layer (23a of Fig. 3), used for gate line or contact pattern in a display device (Fig. 4a, Fig. 4b) incorporating nitrogen throughout the film (lines 45-51 of column 5), in order to reduce formation of hillocks in the aluminum layer (see abstract and lines 24-45 of column 5).

Thus it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate nitrogen into the aluminum layers

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of Liu et al., as taught by Hong, since this will suppress hillock formation in the aluminum layer.

Regarding claim 10, Liu et al. disclose that the gate layer (34a) comprises aluminum (lines 20-22 of column 4), however, fail to teach that the gate layer (34a) incorporates nitrogen.

However, Hong teaches gate layer comprising aluminum incorporating nitrogen.

Same reason for combining art as in claim 9 applies (see rejection of claim 9).

Regarding claim 11, Hong discloses that the aluminum film 23a comprises an aluminum nitride (ceramic formed of Al –N) subphase 27a (lines 3-7 of column 5). The same reason for combining art as in claim 9 applies.

Regarding claim 12, Liu et al. disclose that the cathode 40 comprises a dielectric layer 32a (see Fig 7) between the gate layer 34a and the aluminum film 22 (Fig. 7, lines 10-15 of column 4).

Claim 17 recites essentially the same limitations of claim 6, thus claim 18 is rejected as claim 6 (see rejection of claim 6).

Claim 19 recites essentially the same limitations of claim 8, thus claim 19 is rejected as claim 8 (see rejection of claim 8).

Claims 3 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. In view of Hong as applied to claims 1 and 9 above, and further in view of Raina (US 6064149).

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Regarding claims 3 and 13, combined structure of Liu et al. and Hong teach all the limitations of claim 3 and 13, except for a layer of grid silicon between the dielectric layer and the gate layer.

However, Raina discloses a field emission device (Fig. 6) having a gate electrode structure (69 of Fig 4) comprising a layer of grid silicon (silicon adhesion layer 42 of Fig. 4) between the dielectric layer (40) and the gate layer (44, see lines 25- 41 of column 7 & claims 1 and 2 in column 9) in order to provide strong adhesion with underlying dielectric layer which will prevent delamination during planarization (see abstract).

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have a grid silicon layer, as discloses by Raina, in the combined structure of Liu and Hong, since this will provide a strong adhesion of grid structure with the underlying dielectric layer, further preventing delamination of layers during planarization.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. In view of Hong as applied to claim 9 above, and further in view of Feng et al. (US 5902650).

Regarding claim 14, combined structure of Liu et al. and Hong teach all the limitations of claim 14, except for a layer of semiconductor between the dielectric layer and the aluminum film.

However, Feng et al. disclose a field emission cathode (Fig. 2) including a semiconductor layer (silicon layer 52) between the dielectric layer (56) and the metal cathode structure (62), in order to controls resistivity of the layer (52) such

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that it can prevent excessive current flow if micro-tip shorts to metal gate layer 58 (lines 38-42 of column 5).

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a semiconductor layer (silicon layer 52) between the dielectric layer and the metal cathode layer (62), as taught by Feng et al., in the combined structure of Liu et al. and Hong, since this will prevent flow of excessive current by controlling the resistivity of the semiconductor layer, in case of short between micro-tip and the gate electrode.

***Allowable Subject Matter***

Claims 4-5, 7, 15-16, and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claims 4 and 15, the prior art of record neither shows nor suggests a field emission device or a field emission cathode comprising all the limitations set forth in claim 4 or in claim 15, particularly comprising the limitation of aluminum film having atomic composition of about 2%-10% nitrogen.

Regarding claims 5 and 16, the prior art of record neither shows nor suggests a field emission device or a field emission cathode comprising all the limitations set forth in claim 5 or in claim 16, particularly comprising the limitation of aluminum film having atomic composition of about 5%--8% nitrogen.

Regarding claims 7 and 18, the prior art of record neither shows nor suggests a combination of limitations set forth in claim 7 or claim 18, particularly



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comprising the limitation of aluminum film having a surface roughness of about 300A° to 400A°.

Claims 31-36 are allowed, for same reasons stated above.

### ***Response to Arguments***

Applicant's arguments filed 12 April 2004 have been fully considered but they are not persuasive.

Though Hong discloses that nitrogen ion concentration is mainly on the exposed surface of the aluminum layer and also on the side of the aluminum layer, Hong also indicated that " nitrogen generally has a Gaussian distribution from the surface of the gate pattern 23a, the gate line and the contact pattern 23b to the inside. Thus, most of the nitrogen ions exist at the surface. But some of the nitrogen atoms will be present inside the layer besides the exposed surface thus Hong's aluminum layer contains nitrogen throughout the aluminum layer.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will

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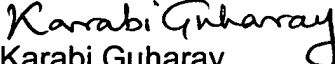
the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

**Contact Information**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karabi Guharay whose telephone number is (571) 272-2452. The examiner can normally be reached on Monday-Friday 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar D. Patel can be reached on (571) 272-2457. The fax phone number for the organization is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Karabi Guharay  
Patent Examiner  
Art Unit 2879

  
VIP PATEL  
PRIMARY EXAMINER